.

Q. Code:..... **Reg. No:.....** **Name:.....**

B SC DEGREE END SEMESTER EXAMINATION MARCH 2019

SEMESTER - 2: MATHEMATICS (COMPLEMENTARY COURSE FOR PHYSICS & CHEMSITRY)

COURSE CODE : 15U2CPMAT2 : INTEGRAL CALCULUS AND MATRICES

Time: Three Hours **Max. Marks:75**

Part A

Answer all Questions
Each Question Carries 1 mark

1. Find the area under the curve $y = x$ from $x = 1$ to $x = 2$.
2. Find $\int_{-\frac{\pi}{4}}^{0} \sec x \tan x \ dx$
3. Use the Substitution Formula to evaluate $\int_{-1}^{1} \frac{5r}{(4+r^2)^2} \ dr$.
4. Write the formula to find the surface area generated by revolving a curve $f(x)$ about X-axis.
5. State Fubini's Theorem.
6. Find the average value of $f(x,y) = x\cos(xy)$ over the rectangle $R : 0 \le x \le \pi$ and $0 \le y \le 1$.
7. State Cayley Hamilton Theorem.
8. What is the rank of the matrix $\begin{bmatrix} -1 & -1 \\ -1 & -1 \end{bmatrix}$?
9. What is a homogeneous equation. Give an example.
10. Define the term singular matrix.

(10 X 1 = 10)

Part B

Answer Any Eight Each Question Carries 2 marks

11. Find the average value of $f(t) = t^2 - t$ on [-2,1].
12. Find $\frac{dy}{dx}$, when $y = \int_{\sqrt{x}}^{0} \sin(t^2)dt$.
13. Find the length of the curve $x = 1 - t, y = 2 + 3t, -2/3 \le t \le 1$.
14. Find the volume of the solid generated by revolving the region between $y = x^2$ and $y = 0$ about the X-axis between $x = 0$ and $x = 2$.
15. Find the area of the region enclosed by the curves $x = 2y^2, x = 0$ and $y = 3$.

16. Integrate $f(x,y) = x/y$ over the region in the first quadrant bounded by the lines $y = x, y = 2x, x = 1, x = 2$.

17. Change $\int_{-1}^{1}\int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}} dy\ dx$ to a polar integral and evaluate.

18. Use double integration to find the area of the region bounded by the coordinate axes and the line $x + y = 2$.

19. Find all the solutions of the following system of 2 equations:

$$\begin{aligned} x + y + z &= 4 \\ 2x + 5y - 2z &= 3 \end{aligned}$$

20. Use Cramer's rule to solve the system of equations

$$\begin{aligned} 2x - 7y &= 12 \\ -4x + 5y &= -6 \end{aligned}$$

(8 X 2 = 16)

Part C

Answer Any Five Each Question Carries 5 marks

21. State the Max-Min Inequality in integration. Show that the value of $\int_0^1 \sin(x^2)dx$ cannot possibly by 2.

22. Find the total area of the region between the X-axis and the curve $f(x) = -x^2 - 2x$, where $-3 \le x \le 2$.

23. Apply the parametric formula to find the length of the astroid $x^{2/3} + y^{2/3} = 1$.

24. Reverse the order of integration, and evaluate the integral $\int_0^{\pi}\int_x^{\pi} \frac{\sin y}{y}\ dy\ dx$.

25. Evaluate $\int_0^1\int_0^{2-x}\int_0^{2-x-y} dz\ dy\ dx$.

26. Solve the following system of equations using Matrix inversion method

$$\begin{aligned} 2x + 3y + z &= 9 \\ x + 2y + 3z &= 6 \\ 3x + y + 2z &= 8 \end{aligned}$$

27. Using the elementary row transformations, find the rank of the matrix. $\begin{bmatrix} 1 & 2 & -1 & 4 \\ 2 & 4 & 3 & 5 \\ -1 & -2 & 6 & -7 \end{bmatrix}$

(5 X 5 = 25)

Part D

Answer Any Two Each Question Carries 12 marks

28. State the Fundamental Theorem of Calculus. Find a function $y = f(x)$ in the domain $(-\pi/2, \pi/2)$ with $\frac{dy}{dx} = \tan x$ and $f(3) = 5$.

29. Find the volume of the region D enclosed by the surfaces $z = x^2 + 3y^2$ and $z = 8 - x^2 - y^2$.

30. Find the volume of the prism whose base is the triangle in the XY -plane bounded by the X-axis an the lines $y = x$ and $x = 1$ and whose top lies in the plane $z = f(x,y) = 3 - x - y$.

31. Determine the characteristic roots and associated invariant vectors of $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$

(2 X 12 = 24)